Claims

What is claimed is:

1. An apparatus for filling and cleaning an analytical substrate of the type having microchannels comprising:

a manifold in fluid communication with said substrate for distributing solution from a container to inlet ports of said microchannels and for removing by suction solution from said substrate inlet ports with a vacuum source;

an injector in pressure communication with the substrate for injecting a liquid media into the microchannels through an anode port of said substrate wherein each of said plurality of microchannels is formed on a surface of said substrate and has an inlet port defined at an end thereof; and

a tube-in-tube assembly having a plurality of tube assembly pressure tubes and a plurality of tube assembly vacuum tubes paired one inside the other for fluidic and pressure communication with said manifold and said inlet ports of said substrate.

2. The apparatus of claim 1 wherein said liquid media is a separation media.

3. The apparatus of claim 1 wherein the manifold has a first chamber for providing pressurized solutions from said container to said substrate and a second chamber for vacuuming solution from said substrate with said vacuum source.

4. The apparatus of claim 3 wherein said first chamber of said manifold means is above the second chamber of said manifold.

5. The apparatus of claim 4 wherein said first chamber of the manifold comprises a plurality of compartments.

6. The apparatus of claim 5 wherein said compartments have at least one opening.

7. The apparatus of claim 6 further comprising at least one pressure supply tube connected to said container of solution and inserted into the openings of said compartments.

8. The apparatus of claim 7 wherein said compartments have a plurality of openings on a lower surface of said compartments receiving said tube-in-tube assembly.

9. The apparatus of claim 8 wherein said plurality of pressure tubes of said tube-in-tube assembly is inserted into said plurality of openings on said lower surface of said first chamber of the manifold.

10. The apparatus of claim 4 wherein said second chamber of the manifold comprises a plurality of compartments.

11. The apparatus of claim 10 wherein said second chamber of the manifold comprises three compartments.

12. The apparatus of claim 10 wherein said compartments have at least one opening.

13. The apparatus of claim 12 further comprising at least one vacuum supply tube connected to said vacuum source and inserted into the openings of said compartments.

14. The apparatus of claim 10 wherein said compartments have a plurality of openings on a lower surface of said compartments receiving said tube-in-tube assembly.

15. The apparatus of claim 14 wherein said openings on said lower surface are larger than openings on a lower surface of a first chamber of said manifold wherein said first chamber is above said second chamber.

16. The apparatus of claim 15 wherein said plurality of pressure tubes of said tube-in-tube assembly are inserted into said plurality of vacuum tubes of said tube-in-tube assembly.

17. The apparatus of claim 16 wherein said plurality of tube assembly vacuum tubes are present in said plurality of lower surface openings of said second chamber and said tube assembly pressure tubes are present in said plurality of lower surface openings of said first and second chamber.

18. The apparatus of claim 16 wherein the number and the spacing of the inlet ports of the substrate correspond to the number and spacing of said plurality of tube assembly pressure tubes inserted within said plurality of tube assembly vacuum tubes corresponds to the number and the spacing of the inlet ports of the substrate.

19. An apparatus for filling and cleaning an analytical substrate of the type having microchannels therein comprising:

a container said container storing a liquid solution;

a vacuum source;

a manifold in fluid communication with said substrate in solution distribution communication from said container to inlet ports of said substrate and in solution removal communication by suction from said substrate inlet ports; and

an injector in pressure communication with the substrate injecting a liquid media into a plurality of microchannels through an anode port of said substrate wherein each of said plurality of microchannels is formed on a surface of said substrate and has an inlet port and is associated with an anode port.

20. The apparatus of claim 19 further comprising an assembly for fluidic and pressure communication with said manifold and said substrate wherein said assembly allows for simultaneous suction and distribution of fluid to and from said manifold and said substrate.

21. The apparatus of claim 19 further comprising a tube-in-tube assembly having at least one tube assembly pressure tube paired inside a tube assembly vacuum tube for fluidic and pressure communication with said manifold and said inlet ports of said microchip.

22. The apparatus of claim 21 wherein said tube-in-tube assembly has an upper and a lower end.

23. The apparatus of claim 21 further comprising a robotic stage for moving said tube in tube assembly between inlet ports.

24. The apparatus of claim 19 further comprising a platform having alignment pins for holding said substrate.

25. The apparatus of claim 19 further comprising an arm attached to said manifold for raising said manifold away from said substrate and for lowering said manifold into contact with said substrate.

26. The apparatus of claim 25 further comprising an adjustable stop for positioning said manifold.

27. The apparatus of claim 25 further comprising a sensor assembly indicating when said manifold has been lowered.

28. The apparatus of claim 19 wherein said injector has at least one spring loaded injector tip.

29. The apparatus of claim 19 wherein said manifold has a first chamber for providing pressurized solutions from said container to said substrate and a second chamber for vacuuming solution from said substrate with said vacuum source.

30. The apparatus of claim 29 wherein further comprising compartments within said chambers and a separate control associated with said compartments.

31. The apparatus of claim 19 further comprising a central electronic control unit.

32. The apparatus of claim 19 wherein operation of said apparatus is automated.

33. An apparatus for filling and cleaning an analytical substrate of the type having microchannels therein comprising:

a container configured to hold a solution;

a vacuum source;

a manifold in pressure tight fluid communication with said container and vacuum source providing solution from the container to said substrate and vacuuming solution from said substrate with said vacuum source, said manifold having an upper chamber with a plurality of compartments with opposed openings and a plurality of openings on a lower surface of said plurality of compartments, and a lower chamber with a plurality of compartments with opposed openings, and a plurality of openings an a lower surface of said plurality of compartments, wherein said plurality of openings on said lower surface of said lower chamber are larger than said plurality of openings on said lower surface of said upper chamber compartments; and

an injector in pressure communication with the substrate for injecting a liquid media into the microchannels through an anode port of said substrate wherein each of said plurality of microchannels is formed on a surface of said substrate and has an inlet port;

a plurality of pressure supply tubes inserted

into opposed openings of said upper chamber compartments and connected to said at least one container;

a plurality of vacuum supply tubes inserted into said opposed openings of said lower chamber compartments and connected to said at least one vacuum source; and

an assembly for fluidic and pressure communication with said compartments of said upper and lower chambers of said manifold and inlet ports of said substrate wherein said assembly allows for simultaneous distribution and suction of fluid to and from said substrate and said upper and lower chambers of said manifold.

34. A method for cleaning an analytical substrate of the type having microchannels therein comprising:

(a) engaging a plurality of inlet ports of said substrate with a device for providing wash solution and suction into said substrate;

(b) engaging an anode port of said substrate;

(c) simultaneously introducing solution into said plurality of inlet ports and removing by vacuum solution from said inlet ports;

(d) introducing solution into a plurality of microchannels through said anode port wherein each of said microchannels is formed on a surface of said substrate and has an inlet port;

(e) repeating steps (c) and (d) until said plurality of microchannels on said substrate have been cleaned; and

(f) vacuuming remaining solution.

35. The method of claim 34 wherein steps (a) and (b) occur independently of each other.

36. The method of claim 34 further comprising the step of filling said microchannels with separation media through said anode port.

37. The method of claim 36 further comprising robotically moving said microchip substrate to a loading station or a storage station.

38. The method of claim 37 whereby following robotically moving the substrate the method of further includes the steps of:

i) moving a loading device relative to sample wells containing sample, the sample having tagged target molecules with characteristic migration rates, and picking up sample with said loading device;

ii) delivering said sample from the loading device into the inlet ports;

iii) repeating steps i) and ii) until a desired number of inlet ports have received sample; and

iv) causing sample separation in the microchannels until desired sample separations are achieved.

39. The method of claim 34 wherein said method occurs after said substrate has been used in a molecular separation and microchannel chemical analysis process.

40. The method of claim 34 wherein said method occurs robotically.